This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1.   (CURRENTLY AMENDED) An apparatus for monitoring a swing path and/or a golf club head angle at or near an impact location with a golf ball during a golf swing, comprising:

a golf ball impact location for receiving a golf ball;

a first array of sensors proximate to the impact location;

a second array of sensors spaced apart from the first array behind the impact position along a ~~the~~ swing path, the first and second array positioned such that a golf club swung in preparation for contact with a golf ball at the impact location will have a swing plane in angular relation to the first and second arrays;

an image capture device including a camera for capturing two or more images of the golf ball after impact with the golf club head; and

a processor for receiving signals indicative of a temporal profile of which sensors the golf club head is over during the swing <u>and for determining at least one of a swing path and a club head angle of the golf club based on said signals indicative of the temporal profile, the processor further</u> ~~and~~ for determining <u>three-dimensional velocity</u> ~~one or more dynamic parameters~~ of the golf ball <u>by extrapolating perimeters of two or more images taken using the camera</u>, ~~based on said two or more images~~ <u>and by determining three-dimensional spatial positions of the ball in said images</u> and ~~for~~ calculating <u>the three-dimensional velocity</u> ~~one or more flight parameters of a total flight path~~ of said golf ball based on said <u>three-dimensional spatial positions</u> ~~one or more dynamic parameters~~.

2.   (ORIGINAL) The apparatus of Claim 1, wherein said first and second arrays include a plurality of sensors arranged substantially linearly and orthogonal to said swing plane.

3.   (CURRENTLY AMENDED) The apparatus of any of Claims 1 or 2, <u>wherein</u> the processor <u>is</u> further for using the signals indicative of the temporal profile to determine a swing path of the club head ~~as the club head moved~~ between the first and second arrays during the swing.

4.   (CURRENTLY AMENDED) The apparatus of Claim 3, wherein the processor is further for determining a take away swing path <u>of</u> [[as]] the club head ~~moved~~ from the first array to the second array during the swing and a downswing path <u>of</u> [[as]] the club head ~~moved~~ from the second array to the first array towards the impact location during the swing.

5.   (CURRENTLY AMENDED) The apparatus of any of Claims 1 or 2, <u>wherein</u> the processor <u>is</u> further for using the <u>received signals to determine <u>the</u> [[an]] angle of [[a]] <u>the</u> golf club head during <u>movement of</u> ~~a period when~~ the club head ~~moved~~ across the first array toward the impact location.

6.   (PREVIOUSLY AMENDED) The apparatus of Claim 5, wherein the first array includes a back sensor that is positioned just behind the substantially linearly arranged sensors in the first array along a swing path of the golf club, for determining the club head angle.

7.   (CURRENTLY AMENDED) An apparatus for monitoring a golf club head angle at or near an impact location of the club head with a golf ball during a golf swing, comprising:

an array of sensors arranged at an angle to a plane of a golf swing of a golf club head;

an image capture device including a camera for capturing two or more images of a golf ball after impact with the golf club head; and

a processor for receiving signals indicative of a temporal profile of which sensors the golf club head is over ~~for the duration of~~ <u>during</u> the swing <u>and for determining a club head angle of the golf club based on the signals indicative of the temporal profile, the processor further</u> [[and]] for determining <u>three-dimensional displacement</u> ~~one or more dynamic parameters~~ of the golf ball <u>by extrapolating perimeters of two or more images taken using the camera</u> ~~based on said two or more images,~~ <u>by determining three-</u>

dimensional spatial positions of the ball in said images and [[for]] calculating the three-dimensional displacement one or more flight parameters of a total flight path of said golf ball based on said three-dimensional spatial positions one or more dynamic parameters.

8.   (PREVIOUSLY AMENDED) The apparatus of Claim 7, wherein said array includes a plurality of sensors arranged substantially linearly and orthogonal to a swing path of the golf club head.

9.   (ORIGINAL) The apparatus of Claim 8, wherein said array further includes a back sensor behind said plurality of substantially linearly arranged sensors.

10.   (CURRENTLY AMENDED) The apparatus of any of Claims 7-9, wherein the processor is for determining the club head angle and swing path as the club head was sensed over at least one of the first and second arrays based on said signals indicative of the temporal profile.

11.   (ORIGINAL) The apparatus of any of Claims 1 or 7, wherein said golf ball includes a marking that is at least partially in view of the camera for any rotational position of the golf ball.

12.   (CURRENTLY AMENDED) The apparatus of Claim 11, wherein said marking is substantially a straight line stripe at least halfway circumambulatory of the surface of the golf ball.

13.   (ORIGINAL) The apparatus of Claim 11, wherein said marking is a closed loop around the surface of the golf ball.

14.   (ORIGINAL) The apparatus of Claim 13, wherein said marking separates substantially equal hemispheres of the golf ball.

15.   (ORIGINAL) The apparatus of Claim 12, wherein said marking separates substantially equal hemispheres of the golf ball.

16. (ORIGINAL) The apparatus of Claim 12, wherein said processor automatically finds said marking and calculates a linear extrapolation of said marking for each of said images.

17. (PREVIOUSLY AMENDED) The apparatus of Claim 16, wherein said processor calculates backspin on said ball based on a comparison of said linear extrapolation from at least two of said images.

18. (PREVIOUSLY AMENDED) The apparatus of Claim 17, wherein said processor calculates sidespin on said ball based at least in part on curvatures of said marking on at least two of said images.

19. (CURRENTLY AMENDED) The apparatus of Claim 7 [[16]], wherein said processor automatically finds a perimeter of each of said images at least one image and calculates a circumferential extrapolation of each of said images image.

20. (PREVIOUSLY AMENDED) The apparatus of Claim 19, wherein said processor determines diameters of said two or more images based on said circumferential extrapolations of said two or more images and calculates a three-dimensional velocity of said ball based in part on a comparison of said diameters.

21. (ORIGINAL) The apparatus of Claim 19, wherein said processor calculates a diameter based on said circumferential extrapolation and calculates a three dimensional velocity of said ball based in part on said diameter.

22. (CURRENTLY AMENDED) The apparatus of Claim 12, wherein said processor automatically finds a perimeter of said at least two images one image and calculates a circumferential extrapolation of said images image.

23. (PREVIOUSLY AMENDED) The apparatus of Claim 22, wherein said processor determines diameters of said two or more images based on said circumferential extrapolations

from said two or more images and calculates a three-dimensional velocity of said ball based in part on a comparison of said diameters.

24.   (ORIGINAL) The apparatus of Claim 22, wherein said processor calculates a diameter based on said circumferential extrapolation and calculates a three dimensional velocity of said ball based in part on said diameter.

25.   (ORIGINAL) The apparatus of Claim 12, wherein said processor calculates sidespin on said ball based in part on curvatures of said marking on said images.

26.   (ORIGINAL) The apparatus of Claim 25, wherein said processor calculates a circumferential extrapolation of two or more of said images.

27.   (ORIGINAL) The apparatus of Claim 26, wherein said processor calculates three-dimensions of velocity based in part on a comparison of diameters of two or more of said circumferential extrapolations.

28   (ORIGINAL) The apparatus of Claim 27, wherein said processor calculates sidespin based in part on curvatures of said marking on said images.

Claims 29-32. (CANCELLED)

33.   (CURRENTLY AMENDED) The apparatus of Claim 7 [[11]], wherein said processor is further for determining ~~one or more parameters include~~ three dimensional velocity based upon said three-dimensional spatial positions.

34.   (CURRENTLY AMENDED) An apparatus for determining spin characteristics ~~one or more dynamic parameters~~ of a golf ball after impact with a golf club head ~~based on two or more images of said golf ball captured after said impact and for calculating one or more parameters of a total flight path of said golf ball based on said one or more dynamic parameters,~~ comprising:

an image capture device including a camera for capturing two or more images of the golf ball after impact with the golf club head; and

a processor connected with said image capture device,

wherein said golf ball has a at least one marking that is at least halfway circumambulatory of the surface of said golf ball such that said marking is at least partially within the view of said camera for any rotational position of said golf ball when said images are taken, and

wherein said processor determines spin one or more dynamic parameters of said ball based on an automatic determination of at least one characteristic of only one of said markings at least one of said markings, a three-dimensional position of one or more of said images and diameters of one or more of said on images captured only with said camera.

35. (ORIGINAL) The apparatus of Claim 34, further comprising one or more sensors for triggering the capturing of the images by the camera.

36. (ORIGINAL) The apparatus of Claim 35, wherein the one or more sensors are one or more photosensors that sense the club head as the club head moves past the one or more sensors during a downswing prior to impact with the ball.

37. (ORIGINAL) The apparatus of any of Claims 34 or 35, wherein said marking is a closed loop around the surface of the golf ball.

38. (ORIGINAL) The apparatus of Claim 37, wherein said marking separates substantially equal hemispheres of the golf ball.

39. (ORIGINAL) The apparatus of any of Claims 34 or 35, wherein said marking separates substantially equal hemispheres of the golf ball.

40.   (ORIGINAL) The apparatus of any of Claims 34 or 35, wherein said processor automatically finds said marking and calculates a linear extrapolation of said marking for each of said images.

41.   (PREVIOUSLY AMENDED) The apparatus of Claim 40, wherein said processor calculates backspin on said ball based on a comparison of linear extrapolations from at least two of said images.

42.   (ORIGINAL) The apparatus of Claim 41, wherein said processor calculates sidespin on said ball based at least in part on curvatures of said markings on said images.

43.   (PREVIOUSLY AMENDED) The apparatus of Claim 34 , wherein said processor automatically finds a perimeter of at least one image and calculates a circumferential extrapolation of said image.

44.   (CURRENTLY AMENDED) The apparatus of Claim 43, wherein said processor determines diameters of said two or more images based on circumferential extrapolations from said two or more images and calculates a three-dimensional velocity of said ball based in part on a comparison of said diameters, and wherein said calculation is independent of an orientation of the circumambulatory marking on said images.

45.   (ORIGINAL) The apparatus of Claim 43, wherein said processor calculates a diameter based on said circumferential extrapolation and calculates a three dimensional velocity of said ball based in part on said diameter.

46.   (ORIGINAL) The apparatus of any of Claims 34 or 35, wherein said processor automatically finds a perimeter of at least one image and calculates a circumferential extrapolation of said image.

47.   (PREVIOUSLY AMENDED) The apparatus of Claim 46, wherein said processor determines diameters of said two or more images based on circumferential extrapolations from

said two or more images and calculates a three-dimensional velocity of said ball based in part on a comparison of said diameters.

48. (ORIGINAL) The apparatus of Claim 46, wherein said processor calculates a diameter based on said circumferential extrapolation and calculates a three dimensional velocity of said ball based in part on said diameter.

49. (ORIGINAL) The apparatus of any of Claims 34 or 35, wherein said processor calculates sidespin on said ball based in part on curvatures of said marking on said images.

50. (ORIGINAL) The apparatus of Claim 49, wherein said processor calculates a circumferential extrapolation of two or more of said images.

51. (CURRENTLY AMENDED) The apparatus of Claim 50, wherein said processor calculates three-dimensions of velocity based in part on a comparison of diameters of circumferential extrapolations from two or more of the images, and wherein said calculation is independent of any determined characteristic of the marking on said images.

52. (ORIGINAL) The apparatus of Claim 51, wherein said processor calculates sidespin based in part on curvatures of said marking on said images.

53. (CURRENTLY AMENDED) The apparatus of any of Claims 34 or 35, wherein said spin is a type of spin one or more dynamic parameters are selected from a group of dynamic parameters consisting of backspin[[,]] and sidespin and three dimensional velocity.

54. (CURRENTLY AMENDED) The apparatus of any of Claims 34 or 35, wherein said spin is backspin one or more dynamic parameters are determined based on a diameter calculated based on an automatic circumferential extrapolation of at least one image, the curvature of the marking on at least one image, and automatic linear extrapolations of the markings on at least two images.

Claim 55. (CANCELLED)

56.   (CURRENTLY AMENDED) The apparatus of any of Claims 34 or 35, wherein said ~~one or more dynamic parameters include~~ spin is sidespin.

57.   (CURRENTLY AMENDED) The apparatus of any of Claims 34 or 35, wherein said processor is further for determining three-dimensional velocity of said ball ~~one or more dynamic parameters include three-dimensional velocity~~.

58.   (ORIGINAL) The apparatus of Claim 34, further comprising two sensors, said processor for receiving signals indicative of when the golf club is detected by each of the two sensors and estimating when the golf ball will be within a view of said camera for capturing said one or more images based on the received signals.

59.   (ORIGINAL) The apparatus of any of Claims 35-36, wherein said one or more sensors include at least two sensors, wherein said processor receives signals indicative of when the golf club is detected by each of the at least two sensors and estimates when the golf ball will be within a view of said camera for capturing said one or more images based on the received signals.

60.   (CURRENTLY AMENDED) An apparatus for determining ball velocity in three dimensions ~~one or more dynamic parameters~~ of a golf ball after impact with a golf club head ~~based on two or more images of said golf ball captured after said impact and for calculating one or more parameters of a total flight path of said golf ball based on said one or more dynamic parameters~~, comprising:

          an image capture device including a camera for capturing two or more images of the golf ball after impact with the golf club head; and

          a processor connected with said image capture device for calculating a three-dimensional ball velocity by determining ~~automatically determines~~ circumferential extrapolations of perimeters of two or more images obtained only using the camera, by automatically determining and comparing three-dimensional spatial positions of said two

or more images, and by calculating the three-dimensional velocity using ~~based in part on~~ said three-dimensional spatial position determination and comparison.

61.   (CURRENTLY AMENDED) The apparatus of Claim 60, wherein the image capture device captures images of the ball using a single camera ~~said processor automatically determines circumferential extrapolations of perimeters of said images from which said three-dimensional spatial positions are determined~~.

62.   (ORIGINAL) The apparatus of Claim 60, wherein said three-dimensional spatial positions are determined based at least in part on a determination of diameters of said images.

Claim 63. (CANCELLED).

64.   (CURRENTLY AMENDED) The [[An]] apparatus of claim 60 wherein ~~for determining one or more dynamic parameters of a golf ball after impact with a golf club head based on one or more images of said golf ball captured after said impact and for calculating one or more parameters of a total flight path of said golf ball based on said one or more dynamic parameters, comprising:~~

~~an image capture device including a camera for capturing one or more images of the golf ball after impact with the golf club head; and~~

~~a processor connected with said image capture device~~ the processor is further for determining a three-dimensional spatial position of the geometric center of at least one image and calculating the [[a]] three-dimensional velocity based in part on said three-dimensional spatial position determination.

65.   (CURRENTLY AMENDED) The apparatus of Claim [[64]] 60, wherein said processor is further for determining three-dimensional displacement of said ball ~~automatically determines a circumferential extrapolation of a perimeter of said image from which said three-dimensional spatial position is determined~~.

Claim 66. (CANCELLED).

67.   (CURRENTLY AMENDED) The apparatus of ~~any of Claims 64-66~~ Claim 60, wherein said three-dimensional velocity is also based at least in part on a timing ~~from a timing~~ of the ball impact and the ~~to a timing of~~ capturing of said ~~image~~ images.

68.   (ORIGINAL) The apparatus of Claim 67, wherein said three-dimensional velocity is also based on a three-dimensional spatial position of said ball at said impact location.

69.   (CURRENTLY AMENDED) An apparatus for determining one or more characteristics of a golf swing ~~dynamic parameters of a golf ball after impact with a golf club head based on two or more images of said golf ball captured after said impact and for calculating one or more parameters of a total flight path of said golf ball based on said one or more dynamic parameters,~~ comprising:

13|

a first and ~~a~~ second sensor arrays ~~sensors~~ spaced-apart along a golf swing path for detecting a golf club head at two different points during a downswing portion of a golf swing;

an image capture device including a camera for capturing two or more images of the golf ball after impact with the golf club head; and

a processor for receiving signals indicative of when the golf club is detected by sensors in each of the two arrays ~~sensors~~ and estimating when the golf ball will be within a view of said camera for capturing said two or more images, the processor further for receiving signals indicative of a temporal profile of which sensors the golf club head is over during the swing and for determining at least one of a swing path and a club head angle of the golf club based on said signals.

70.   (ORIGINAL) The apparatus of Claim 69, at least one of said sensors further for triggering the capturing of the images by the camera.

71. (CURRENTLY AMENDED) The apparatus of any of Claims 69 or 70, wherein the ~~one or more~~ sensors are ~~one or more~~ photosensors that sense the club head as the club head moves past the one or more sensors during a downswing prior to impact with the ball.

72. (ORIGINAL) The apparatus of Claim 70, wherein said at least one of said sensors triggers a shuttering of said camera.

73. (ORIGINAL) The apparatus of any of Claims 70 or 72, wherein said at least one of said sensor triggers a flashing of one or more flashlamps of said camera.

74. (CURRENTLY AMENDED) An apparatus for determining <u>transfer efficiency from a golf club head to a golf ball</u> ~~one or more dynamic parameters of a golf ball after impact with a golf club head based on two or more images of said golf ball captured after said impact and for calculating one or more parameters of a total flight path of said golf ball based on said one or more dynamic parameters~~, comprising:

a first and a second sensors spaced-apart along a golf swing path for detecting a golf club head at two different points during a downswing portion of a golf swing;

an image capture device including a camera for capturing two or more images of the golf ball after impact with the golf club head; and

a processor for receiving signals indicative of when the golf club is detected by each of the two sensors, <u>for using said signals to calculate</u> ~~calculating~~ a speed of the club head during the downswing, <u>for</u> calculating <u>the velocity</u> ~~one or more dynamic parameters~~ of the golf ball based on said two or more images and <u>for using the club speed and the ball velocity to calculate</u> ~~calculating~~ a transfer efficiency of the club head to the golf ball at impact. ~~based at least in part on said club head speed and said one or more dynamic parameters of said golf ball.~~

75. (ORIGINAL) The apparatus of Claim 74, wherein said one or more dynamic parameters include three-dimensional velocity, backspin and sidespin.

76. (ORIGINAL) The apparatus of Claim 74, wherein said transfer efficiency is determined relative to other transfer efficiencies determined for other impacts of other golf swings.

77. (ORIGINAL) The apparatus of any of Claims 60, 64, 69 or 74, wherein said golf ball has a marking that is at least halfway circumambulatory of the surface of said golf ball such that said marking is at least partially within the view of said camera for any rotational position of said golf ball when said images are taken.

78. (ORIGINAL) The apparatus of Claim 77, wherein sidespin on said golf ball is determined based on curvatures of said marking in said images.

79. (PREVIOUSLY AMENDED) The apparatus of Claim 77, wherein said processor automatically finds said marking and calculates linear extrapolations of said markings in said images and determines backspin based on a comparison of said linear extrapolations.

80. (ORIGINAL) The apparatus of Claim 77, wherein said processor automatically determines a circumferential extrapolation of at least one image, calculates a three-dimensional spatial position from said circumferential extrapolation and determines a three-dimensional velocity based at least in part on said three-dimensional spatial position.

81. (PREVIOUSLY AMENDED) The apparatus of Claim 80, wherein said processor calculates a diameter of said at least one image from said circumferential extrapolation and calculates a three-dimensional extrapolation based in part on said diameter.

82. (PREVIOUSLY AMENDED) The apparatus of any of Claims 1, 7, 34, 60, 64, 69 or 74, wherein said apparatus also captures an image of said golf ball and said golf club at impact such that a relative orientation of said club with respect to said ball may be evaluated.

83. (ORIGINAL) The apparatus of Claim 77, wherein said marking is substantially a straight line within a plane of the surface of the ball.

84.   (NEW) The apparatus of Claim 34 wherein the marking is a stripe.

85.   (NEW) The method of Claim 69 wherein the processor is for determining a swing path and a club head angle of the golf club based on said signals.

86.   (NEW) A system for monitoring spin of a golf ball following impact by a golf club, the system comprising:

a golf ball having a stripe thereon;

a camera positioned to capture at least two images of the golf ball following impact by a golf club;

a processor for finding the stripe in images captured only by the camera and for determining a spin of the ball based one or more characteristics of the stripe in said images.

87.   (NEW) The system of claim 86 wherein only one camera captures images of the golf ball following impact by a golf club.

88.   (NEW) The system of claim 86 wherein the ball includes only one stripe.

89.   (NEW) The system of claim 86 wherein the processor determines spin using orientation and/or curvature of the stripe in said images.

90.   (NEW) The system of claim 86, wherein the processor is further for determining three-dimensional velocity of the ball following impact based on the position and dimensions of the ball in said images.

91.   (NEW) The system of claim 90 wherein said processor is further for determining said three-dimensional velocity independent of characteristics of the stripe on said images of the ball.

92.   (NEW) The system of claim 86 wherein said processor calculates a linear extrapolation of said marking in at least two of said images, and calculates backspin on said ball based on a comparison of said linear extrapolations.

93.   (NEW) The system of claim 86 wherein said processor calculates sidespin on said ball based in part on curvatures of said marking on said images.

94.   (NEW) The system of claim 86 wherein the processor is further for determining three-dimensional displacement of the ball following impact based on the position and dimensions of the ball in said images.